M206 Amazon River 1 - Teacher

Lesson plan The Amazon River

Lesson Objective(s)

This is a task-based, level B1/B2 skills lesson, involving listening and reading for detail, and speaking. There is also an optional matching exercise for pre-teaching vocabulary, and a 17-question Kahoot for reviewing the material afterwards. Timing: 90 - 130 mins as follows: PART 1 45-60 mins, PART 2 10 – 15 mins PART 3 20 mins PART 4 20 - 30 mins (Optional – Kahoot 10 mins).

Students will need access to the internet and ideally to a tablet or laptop, in order to use Google Earth, and for the Kahoot, if required. All the other materials are available with this document or from the links therein.

There is one audio to listen to and two videos to watch.

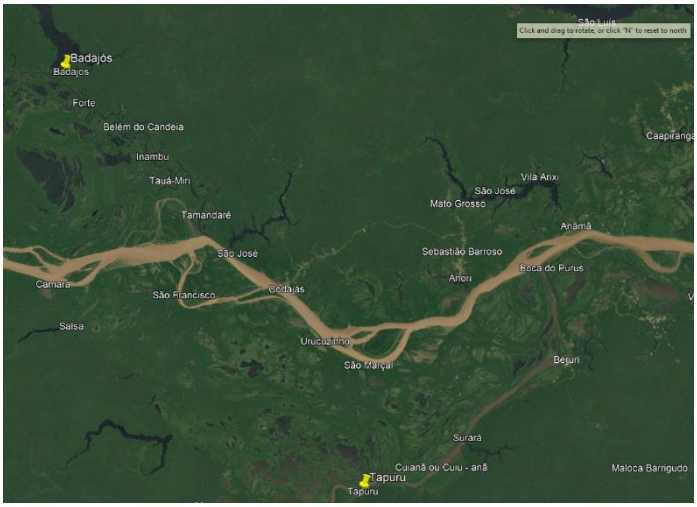
https://audio.com/clive-maguire/projects/1816598109648565 (4 mins, personal narrative)

https://youtu.be/IGUt4OZL2Z8 3 mins, animation, The Geotraces programme)

https://www.youtube.com/watch?app=desktop&v=E6GT2Vc5uog&t=1s (2:33 mins Experiment) Stop this at 00:52 to let ss guess the result.

PART I - A journey through the Amazon.

Board any image of: the amazon region, the RV Meteor research vessel, anything from geotraces.org, the video *The Perpetual Ocean* (link below.)



Students in pairs or groups.

1.1 Scaffold by getting students to brainstorm facts about the Amazon basin region. Elicit as necessary.

1.2 Find the locations in Google Earth. Students will need internet access for this, or it could be done directly by the class, using Google Earth and the references. Using the coordinates is the harder way to get the points; searching for the towns within the area is easier.

Badajós 3°25'8.75"S 62°40'42.41"W
Tapuru 4°17'27.66"S 61°48'20.74"W

Answers to questions 1a – 1e

1(a) Short answer: one is brown water (younger river, faster flowing, from the Andes, has more sediment and nutrients); the other is black water (Older, slower, from the Guiana Shield, stained black, nutrient deficient). Details:

> The Rio Badajós is a dark- or black-water river. These rivers draw their water from one of the oldest rock formations on earth, the Guiana Shield. The soil in this region has been eroded over millions of years and therefore the slow-moving water has very little sediment in it. Much of the

organic matter in the river instead comes from leaf-fall from the trees, and the water is stained back by the acidic tanins in the decomposed leaves – like tea.

The Purus river, and the Amazon itself, are younger rivers orginating in the Andes. They crash down from the mountains, moving relatively quickly, and bring huge volumes of mud and earth with them, which is what gives them their characteristic brown colour. They are faster-flowing, more nutrient-rich, and support more vegetation, animals and insects.

1(b) The route is the only viable one in the dry season – NE down the Purus to the river Amazon (this is fast), then W up the Amazon (much slower, against the current), and finally NW up the winding Badajós river, which takes a long time because it has so many bends in it and is narrow in places. The most difficult sections are the Amazon itself, because of the fast-flowing water and the dangers in crossing it at low water because of sandbanks and submerged trees; and the Badajós because in the dry season the winding channels are sometimes reduced to a trickle.

1(c) It is incredibly dangerous to be on the river at night because of the risk of running into partially submerged tree-trunks, sand banks or even large river boats with inadequate lighting. Also, it is possible to get lost in narrow channels, even on a wide river, and get stranded. Finally, there are river pirates, and smugglers on the river at night.

1(d). Allow students to match the numbers with the images.

1(e) Students can use the tick boxes to tick the animals they think were spotted. The 3 animals that are not found in the Amazon are the crocodile, the salmon and the leopard. I saw all the other animals on this trip.

Listening (link above) 4 minutes. Students check their answers.

PART 2

This section introduces the amazing volumes of water present in the Amazon, and links to the GEOTRACES research being done at the mouth of the river (PART 3).

Students read the introduction and discuss possible answers to the questions.

The first reference is to the amount of water in a a 1m cross section of the Amazon floodplain, and is likely to be ridiculously inaccurate – it just gives some idea of scale. The calculation is width x length x depth, and is therefore 80,000m x 8m x 1m = **640,000 cubic metres**. Multiplying this by the length of the Amazon between Tabatinga (Peru) and Manaus (Brazil) gives an interesting (and wildly inaccurate!) idea of the amount of water in the Amazon at any one time during high water (64000*2,400,000 = **1,536,000,000,000 or 1.5 trillion m3**).

2.1 It is so much quicker because it is sometimes possible at high water to travel almost directly north from Tapuru to the Amazon, **through the floodplain**. The section on the Amazon is difficult and dangerous at this time because of the amount of detritus in the fast-flowing water, but the Badajós river at high water is a slow-moving, wide channel which is like skimming fast over glass.

PART 3

Students watch the 3-minute GEOTRACES animation (link above) and note down the chemical elements mentioned.

The main elements mentioned are **iron, zinc, manganese, mercury, lead, radioactive elements, beryllium, radium, thorium**. Also mentioned are **copper and iron** as trace elements, and **organic matter (DOM).** The crucial one for the GEOTRACES M206 team is iron, which is necessary for all life.

After reading the short introduction, students watch the ocean circulation experiment (link above). STOP the video at 00:52 to allow the students to guess the outcome. BLUE (salt, more dense) sinks: RED (pure, less dense) rises. (Note – this doesn't really involved heat – Amazon water is warmer than the ocean).

DISCUSSION

Students read the rest of the document.

In pairs or groups, students think about the question and prepare and present their answers to the class.

> *"What do you think the difference(s) will be between what the scientists find at low water now (M206, 2024) and what they found at high water in 2018 (M147)? Say why. Think about water flow, water content, weather conditions, accessibility. Have you heard or read anything about what has been happening in the Amazon in the last 5 years? Do you think this will have an effect?"*

For information: we expect access to be difficult, because river levels have fallen to record lows. We expect to find more pollutants (illegal gold mining, chemicals used in drug making etc). We expect lower quantities but more concentration of nutrients and pollutants. The weather will be stormy (beginning of the we season always is) but hot and humid.

The inflow of water from the major rivers around the world are part of the thermohaline convection current, and provide nutrients vital for all sea life. They are also a source of contamination from human activity. They affect all of us through the water that bathes our shores, the seafood we eat and the rain that falls in our reservoirs (for example).

Optional Materials

Kahoot M206 Amazon River 1

https://create.kahoot.it/share/m206-amazon-river-1/e1ce2cbd-1df2-407e-af70-a1bd260d9587

Vocabulary for possible pre-teaching

See next page

Updates/news
Science blog: https://andrea-koschinsky.org/category/m206/
Young Learner pages: https://andrea-koschinsky.org/young-learners-outreach/

Video intro, if required: The Perpetual Ocean

https://www.youtube.com/watch?v=CCmTY0PKGDs

a.m.s.l. (adj)	a type of seaweed
floodplain(n)	Seasonally-flooded land
sediment(n)	A substance that pollutes
tide(n)	a body of water moving in a defined direction
current(n)	to change to a solid or semi-solid state
pollutant(n)	Something that moves things from one place to another
coagulate(v)	above the average level of the sea
sargassum(n)	Matter that falls to the bottom of a liquid
conveyor(n)	the rise and fall of the sea

a.m.s.l. (adj)	a type of seaweed
floodplain(n)	Seasonally-flooded land
sediment(n)	A substance that pollutes
tide(n)	a body of water moving in a defined direction
current(n)	to change to a solid or semi-solid state
pollutant(n)	Something that moves things from one place to another
coagulate(v)	above the average level of the sea
sargassum(n)	Matter that falls to the bottom of a liquid
conveyor(n)	the rise and fall of the sea

M206 Amazon River 1 – Students

PART 1 – A journey through the Amazon

1.1 In pairs or groups, make a note of what you know about the Amazon basin. There are some ideas in the table below. Be ready to share your ideas with the class.

Location		Countries	
Size		Animals	
Climate		Plants	
Language		Other aspects	

1.2 The journey. In 2018, Clive Maguire travelled by speedboat from the village of **Tapuru** on the Purus River to the town of **Badajós** on the Rio Badajós. It took two days, covering a distance of over 300km.

In your pairs or groups:

a. Use Google Earth to find the two locations in the Amazon:

Badajós 3°25'8.75"S 62°40'42.41"W
Tapuru 4°17'27.66"S 61°48'20.74"W

a. Look carefully at the two locations and the connecting rivers. The rivers Purus and Badajós are very different. Can you see any obvious difference from the map? What do you think is the reason?

b. What route do you think Clive took? What bits do you think were most difficult or dangerous? Why?

c. Clive travelled only during daylight hours. Why do you think this is?

d. There is a great biodiversity in the Amazon. Match the photos below, with the names.

1	Arara	☐	5	Pink dolphin	☐	9	Leopard	☐	12	Giant Otter	☐
2	Mosquito	☐	6	Anaconda (snake)	☐	10	Salmon	☐	13	Nail monkey	☐
3	Caiman	☐	7	Blue morpho butterfly	☐	11	Crocodile	☐	14	Titan beetle	☐
4	Howler monkey	☐	8	Arapaima	☐						

e. Which of these do you think Clive saw on his trip? Decide with a partner, and then **listen to see if you were right.** (Tip: there are 3 animals in the list that don't belong in the Amazon).

AUDIO (4 mins) https://audio.com/clive-maguire/projects/1816598109648565

M206 Amazon River 1 – Students

PART 2 – Amazon Floodplains

Read the following information about the Amazon floodplains.

Figure 1 Amazon River in flood - NASA

High water in the Amazon Basin, measured at the Port of Manaus (photo) can be as high as 30m above sea level. At low water, it has been as low as 12m amsl. At this level, the Amazon River itself is usually no more than a few kilometres wide, but at high water, it can be over 100km wide across the floodplains. If the average depth of the water is 8 metres across the floodplain, how much water is there in a 1m x 80km cross-section of the river?

Six months after his first visit to Badajós, Clive made the same journey, in the same speedboat, at the same average speed, but this time he arrived in 8 hours and covered a distance of 160km.

Figure 2 Port of Manaus - Source: SGB

2.1 Why do you think it only took 8 hours for the second journey? (Hint: Measure the straight-line distance between Tapuru and Badajós).

All this water drains down the Andes, 7,000km through the Amazon floodplain, and then pours into the Atlantic Ocean at the rate of 300,000 cubic metres every second – the equivalent of 6 Congos, or 8 Yangztes or 30 Volgas or 100 Niagra Falls …, carrying with it sediment, minerals and nutrients like iron, essential to all life.

Like all other rivers, the water eventually mixes with the sea water and becomes part of the great global ocean that covers 71% of our planet and is constantly circulating around it. We don't think about it that much, but all our lives are heavily influenced by the global ocean systems. How much do we know about how they work?

PART 3 – Into the Ocean

Watch the video "The Geotraces Programme" to find out more about Geotraces. What are the main chemical elements mentioned?

The Amazon accounts for up to 20% of all the freshwater entering the ocean. The outflow from all the world's rivers mix in the oceans and are carried around the planet, driven by the wind, the rain, the tides and the deep ocean currents. Just think – some of the water you use to clean your teeth could have come from the Amazon!

This is why it is important for us to understand what is carried in the river water – both nutrients and pollutants – how it mixes in the oceans, and what its effects are on all living things around the world.

Let's examine how the currents move around the world. We know about the wind and the tides, but these are just part of the story. Deeper down, the oceans are moved by thermohaline currents. These are cur rents driven by differences in heat and density in the water. **Watch the experiment and try to guess what happens.**

M206 Amazon River 1 – Students

The freshwater from the Amazon is a different density to the saltwater, so it rolls over the top of the sea water at first. Then, chemical reactions make all the rich sediment that has been carried down the river for up to 7,000km coagulate and fall to the bottom, so that the water slowly clears. It also mixes with the salt water until it becomes indistinguishable from the ocean water. During this process, different plants and animals benefit from the enormous amounts of nutrients – including iron – in the river water. This is why the water turns from brown (with lots of sediment) to green (with lots of phytoplankton feeding) to clear (or blue) water. We might also see phenomenon like sargassum, which also benefits from the available nutrients, and itself provides food and nutrients to fish and other species.

Figure 3 Photos from the first Amazon Geotraces Cruise, M147, in 2018. Source: Constructor University

Eventually, the water mixes completely and becomes part of the global ocean conveyor system that connects it with the rest of the world.

Clive documented the work done by scientists at the mouth of the Amazon in 2018 on the Amazon-GEOTRACES Rsearch Cruise M147 (at high water) and he will be aboard the MV Meteor again for **Amazon-Geotraces Research Cruise M206** (30th November - 30th December 2024, low water), documenting the work being done to examine trace elements like iron and copper, and dissolved organic matter (DOM) discharged by the river. Seeing how these mix at the river mouth and their impact on biological productivity along the coast and out into the ocean will help build a picture of the contribution the Amazon makes to the composition of the planet's oceans.

Throughout the cruise Clive will be posting further videos and information about life on board, about the scientists and crew involved, and about the work being done and some of the experiments.

PART 4 DISCUSSION

In pairs or groups, think about the following question, and present your ideas to the class.

What do you think the difference(s) will be between what the scientists find at low water now (M206, 2024) and what they found at high water in 2018 (M147)? Say why. Think about water flow, water content, weather conditions, accessibility. Have you heard or read anything about what has been happening in the Amazon in the last 5 years? Do you think this will have an effect?

Further study/thoughts: Why do you think the research is important? How does what is happening at the mouth of the Amazon affect you? What are some of the most important nutrients the sea receives and transports around the world?

Follow the blog and find out!

Science blog: https://andrea-koschinsky.org/category/m206/
Young Learner pages: https://andrea-koschinsky.org/young-learners-outreach/